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Present Status of Biological Control of European Blackberry (*Rubus fruticosus* Aggregate) in Australia

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The rust fungus *Phragmidium violaceum* appeared in southern Australia in February 1984, obviously as an illegal introduction aimed at the biological control of European blackberry. Although spread of the pathogen was rapid, its virulence to the most widespread species of European blackberry (*Rubus procerus*) is low. Permission to import and release more virulent strains of the rust selected in Europe in 1978-83 was received in October 1990 after lengthy delays due to conflicts-of-interest. A strain of rust from central France highly virulent to *R. procerus* was released in Victoria in January 1991 and more widespread releases occurred in October 1991.

Introduction

The rust fungus *Phragmidium violaceum* (Schulz) Winter (Uredinales), a candidate for the biological control of European blackberry (*Rubus fruticosus* L. agg.; Rosaceae) in Australia was discovered as an illegal introduction in Victoria in February 1984 (Marks *et al* 1984). Spread of the rust was rapid and it was able to attack a number of species of the European blackberry aggregate present in Australia (Bruzzese and Field 1985). Field observations indicated that the illegally-introduced strain of the rust was not highly virulent to *R. procerus* P.J. Mueller, the most abundant species of European blackberry in south-eastern Australia. This paper reports on greenhouse studies of the effect of the illegally-introduced strain of the rust on the most widespread blackberry species in Australia and the resultant release of a more virulent strain of the rust from Europe.

Methods and Materials

The effect of the illegally introduced isolate of the rust on *R. procerus* was studied on potted plants in the glasshouse. The method used was identical to that used to study the effect of a highly virulent French isolate of the rust on Australian *R. procerus* in France in 1982. This isolate (*F15*) was collected near Chalon-sur-Saone on *R. procerus* in 1978 and subsequently multiplied on Australian *R. procerus* in the laboratory (Bruzzese and Hasan 1986). A treatment involving repeated inoculations with urediniospores was compared to healthy plants. Potted plants of *R. procerus* were used and plants for the inoculations in 1982 in France and for the inoculations in Australia were derived from root crowns collected from the same *R. procerus* bramble growing at the Keith Turnbull Research Institute. These were cut back to soil level and taken into a greenhouse kept at 20-32°C. Lighting was supplemented to give a day length of 18 hr. When canes started to grow, 20 pots were selected and only one vigorously-growing cane was left in each pot. Ten pots were placed at random in each treatment, which began when the majority of canes had two leaves. There was an inoculation treatment and an untreated control. In the inoculation treatment plants were inoculated twice weekly (Monday and Thursday) with a 0.25 mg/ml suspension of freshly collected urediniospores.

The experiment was stopped after 8 wk (17 inoculations) when the following parameters were measured: number of leaves, total length of stem, dry weight of leaves, dry weight of stems, dry weight of roots (excluding the weight

of the original root crown planted). Plant parts were weighed after drying for one week at 40°C.

Results and Discussion

Although comparison of the efficacy of strain *F15* and the illegal strain could not be carried out at the same time, conditions for both experiments were kept as similar as possible except for potting mix and watering regimes. Comparison of results should therefore give an accurate indication of the difference between the isolates. Results indicate (Table 1) that for all the parameters measured except dry weight of leaves, isolate *F15* has the potential for a greater reduction in biomass than the isolate which was illegally introduced. The largest differences were in the canes where the French strain gave a 30% greater reduction in length.

Table 1. Per cent reduction in blackberry biomass caused by repeated inoculations of two isolates of *Phragmidium violaceum* on *Rubus procerus*.

Biomass Parameter	French *F15*	Illegal
No. of leaves	48	33
Length of canes (cm)	82	54
Dry weight (g)		
Leaves	70	71
Canes	89	59
Roots	61	57

The results led to the conclusion that isolate F15 was potentially more damaging to *R. procerus* than the illegally introduced isolate. In 1986 therefore, approval was sought of the Australian Quarantine and Inspection Service to import 15 isolates selected in Europe for pathogenicity to the European blackberry species naturalised in Australia (Bruzzese and Hasan 1986) which were held in storage in France. Conflicts-of-interest over the importation of the rust (Field and Bruzzese 1985) delayed a decision until October 1989 when approval to import and release the rust was finally received.

The release of all 15 selected isolates of the rust is not desirable due to the inevitable sexual crossing which would result in a hybrid swarm of isolates of unknown pathogenicity to the different blackberry species. For this reason, only strain *F15* was released on *R. procerus*. This first occurred as trial releases in Victoria in January 1991 and then more widely in south-eastern Australia in October-December 1991, a period better suited to the establishment of the rust. Releases of asexual urediniospores were made during the period when the illegally introduced isolate was undergoing its sexual cycle and well before the annual epidemic, in the hope that isolate *F15* will out-compete the former and become the dominant isolate on *R. procerus*. A total of 453 ampoules of freeze-dried urediniospores were distributed to weed-control officers in Victoria, New South Wales and the Australian Capital Territory together with detailed inoculation instructions. Each ampoule, containing 10 mg of spores was sufficient to inoculate one site. Reports indicate that sporulation of the new isolate has occurred at many of the release sites. Isolate *F15* is expected to spread widely during the 1991–2 spring-autumn period and so further releases of this isolate will only be made in areas where little rust activity is found on *R. procerus* in spring-autumn 1992–3.

During the isolate selection studies, Bruzzese and Hasan (1986) found that isolate *F15* was also highly pathogenic to *R. polyanthemus* Lindeb. and *R. ulmifolius* hybrid "Foster" var., two common blackberry species in Victoria which are also heavily attacked by the illegally introduced isolate (Bruzzese, unpublished data). It is expected that *F15* will cause additional damage to these two species. The pathogenicity of *F15* to *R. cissburiensis* Barton & Riddelsd., *R. rosaceus* Weihe & Nees and some *R. ulmifolius* hybrids, species of blackberry highly resistant to the illegally introduced strain, is unknown. Infestations of these will be monitored for attack and if necessary , these species will be screened against the other 14 isolates currently in storage in quarantine and a pathogenic isolate selected for future release.

References

Bruzzese, E. and R.P. Field. 1985. Occurrence and spread of *Phragmidium violaceum* on blackberry (*Rubus fruticosus*) in Victoria, Australia. *Proceedings of the VI International Symposium on Biological Control of Weeds*, 19-25 August 1984, Vancouver, Canada.

Delfosse, E.S.. (ed.) Agriculture Canada, Ottawa, pp. 609-12.

Bruzzese, E. and S. Hasan. 1986. The collection and selection in Europe of isolates of *Phragmidium violaceum* (Uredinales) pathogenic to species of European blackberry naturalised in Australia. *Annals of Applied Biology* **108:** 527-33.

Field, R.P. and E. Bruzzese. 1985. Biological control of blackberries- Resolving a conflict in Australia. *Proceedings of the VI International Symposium on Biological Control of Weeds*, 19-25 August 1984, Vancouver, Canada. Delfosse, E.S. (ed.). Agriculture Canada, Ottawa, pp. 341-9.

Marks, G.C., I.G. Pascoe and E. Bruzzese. 1984. First record of *Phragmidium violaceum* on blackberry in Victoria. *Australasian Plant Pathology* **13:**12-3.